PHILIPS

TU/e technische universiteit eindhoven

Prediction of the Software Release Moment

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Release of a product

- Release of any product should be well-prepared
  - Reserve storages
  - Make an advertisement
- Release date of a product should be known in advance
- During development process, development managers predict the release date of the product on the basis of their experience

Optimistic prediction

- Happens in too many cases
- Leads to marketing started up too early
- Leads to two options
    1. Release an immature product
    2. Postpone the release of the product

Waste of money

- Release an immature product
  - Low quality
  - Many returns
- Postpone the release date
  - Penalty for empty shelves
  - Competitors take the lead

- Both options lead to losses
- For Philips these losses may be millions of euros

Conclusion

Accurate prediction of the release date of a product is vital

Software release

- Consumer electronic devices are equipped with software
- Release of such a device strongly depends on release of its software

Accurate prediction of the software release moment is vital

Project history

- Proposed by Han Schaminee,
  a development manager of Digital Video Business
- Supported by
  - Hans Aerts and Lieuwe De Jong,
    managers from Business Creation Process office, Consumer Electronics Division
  - Jan Dijkstra,
    statistical consultancy group of TU/e
  - Mathematics for Industry,
    post-master program at TU/e
- Being carried out by Natalia Garshina,
  an employee of MI

Mathematics for Industry

- Post-master program
- Background
  - Mathematics
  - Computer sciences
  - Physics
- Training in dealing with industrial problems
  - Modeling weeks
  - Themes
  - 3 small industrial projects (with duration of 3 months)
  - Individual final project (with duration of 8 months)

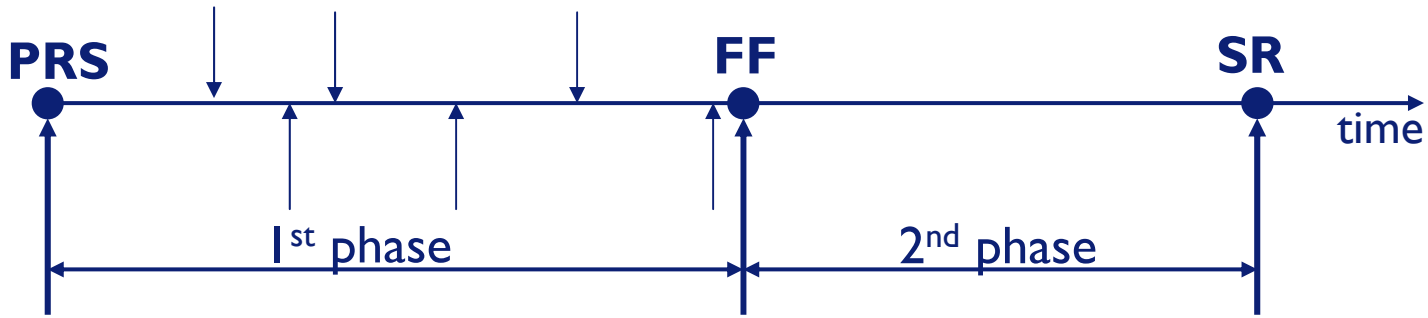
Project goals

- Feasibility of an accurate prediction of the SR moment
- Tool that assists in predicting the SR moment on the basis of data available at the moment of prediction

Requirements

- Prediction accuracy of ±4 weeks at least
- Prediction should exhibit an increasing accuracy in the course of the software development process

Software development process



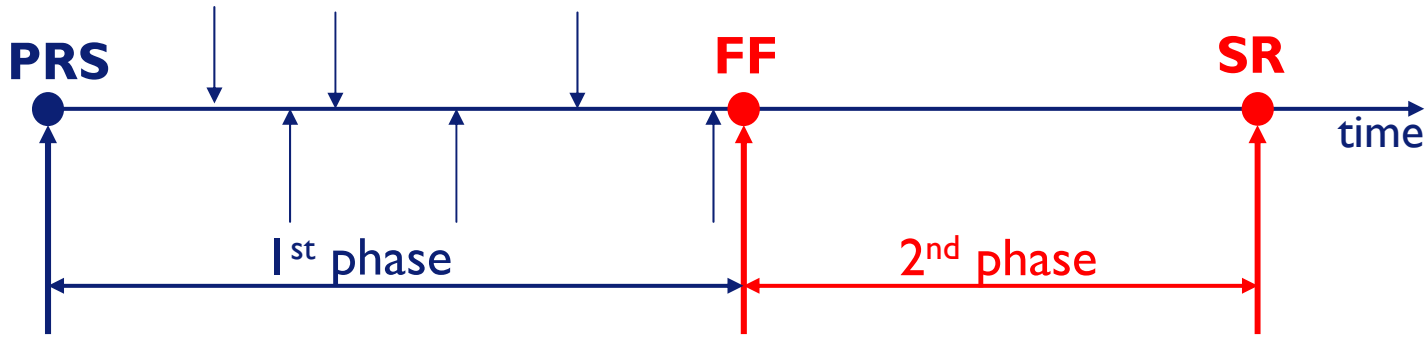
The development of software code is started up

The software code is complete

The software is mature for the market

- 1st phase is developing phase
- 2nd phase is de-bugging phase

Software development process



The development of software code is started up

The prediction of the SR moment is started up

The software satisfies certain criteria

Software Release (SR) moment

- T is the number of Problem Reports to be solved
- T is estimated by the development manager

SR moment is associated with the moment at which all T PRs are solved

Model

- Random processes:
  - finding of PRs
  - solving of PRs
- λ: average number of PRs found per week
- Found PRs enter a queue
- μ: average number of PRs solved per week
- T: total number of PRs to be solved

Idea to use a queueing model

- Paul Siemons,

  the principal consultant of Metrific Management Consult

- Software Reliability Engineering
  - John D. Musa (Germany)
  - Norman Fenton (UK)

Conclusion

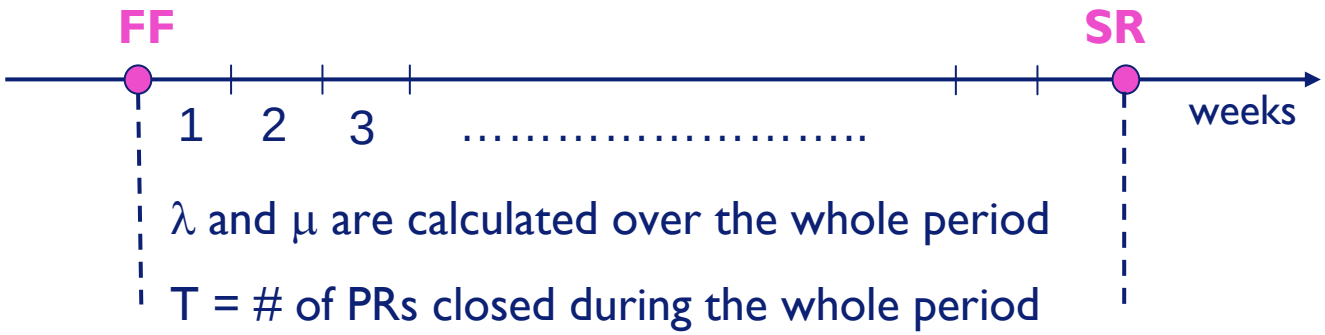
With the presented queuing model accurate prediction is feasible

Checked on data of 10 different development teams:

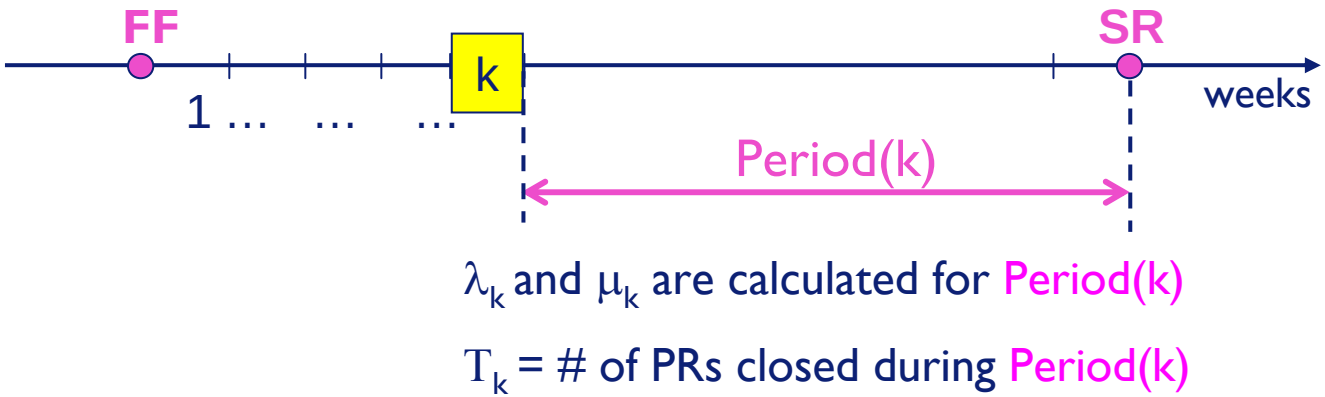
- Whole development period
- Part of development period

Verification of the model

- Whole development period



- Part of the development period



Performance of the model

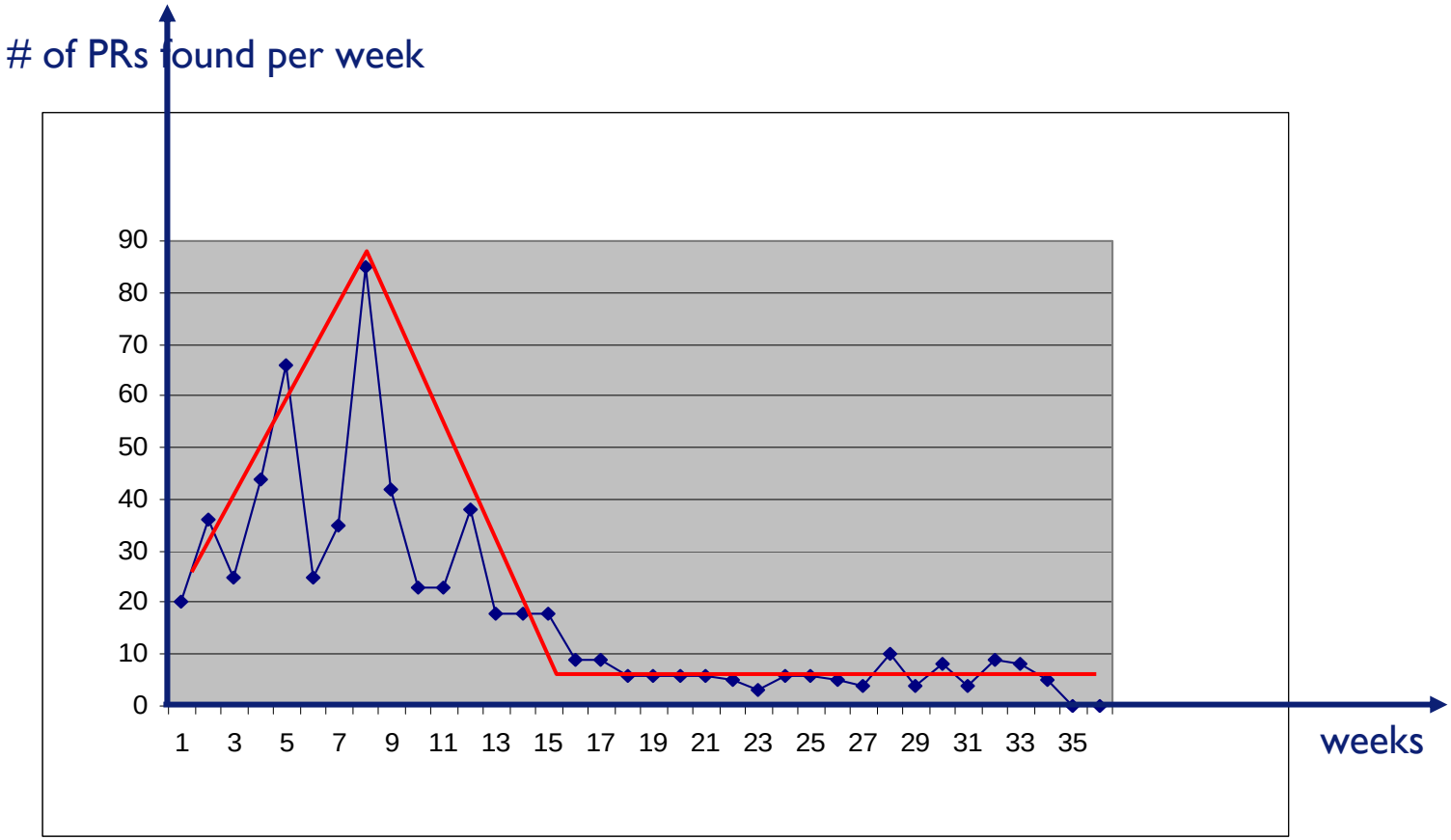
Teams	1	2	3	4	5	6	7	8	9	10
Real SR	20	23	18	19	21	16	16	16	16	16
Estimated SR	21	25	19,6	20,5	24	17	17	17	17	17
σ(SR)	1	2	1,8	1,9	3	1,2	1	0,8	0,8	1

- Estimated SR – σ(SR) < real SR < Estimated SR + σ(SR)
- Estimated SR – real SR < 4 weeks
- Estimated SR > real SR

Estimation of the parameters

- Accurate estimation of the parameters λ and μ implies an accurate prediction of the SR moment
- Estimation should be based on the available data at the moment of estimation
- Collected data
  - number of found PRs per week
  - number of closed PRs per week

Schematic of a development process



Verification of the algorithm

- $\hat{\lambda}_k$ and $\hat{\mu}_k$ are estimated on the basis of the data for the period from FF moment till the week k
- T_k is estimated by the development manager

Results

- Team 1

k	3	4	5	6	7	8	9	10	11	12	13	14
SR	22	17,2	17,5	17,6	17,2	16,5	17,8	17,3	17,7	16,7	17,1	17,2
σ(SR)	2	1,4	1,7	1,5	1,4	1,5	1,8	1,3	1,3	1	1,1	1,3

  - Average SR moment = week 17 ± 1 week
  - Real SR moment was week 16!

- Team 2

k	4	5	6	7	8	9	10	11	12	13	14	15
SR	20,4	17,5	16	15,5	16,3	17	16	16	16,6	16,6	17,2	17,2
σ(SR)	1	0,9	0,8	0,7	0,6	0,7	0,6	0,4	0,4	0,4	0,4	0,3

  - Average SR moment = week 16,5 ± 1 week
  - Real SR moment was week 17!

Conclusions

A tool has been developed, by which an accurate prediction of the SR moment can be calculated

- The tool was checked on the data of 10 different development teams
- The tool provides a prediction with an accuracy ±2 weeks having data of at least 4 weeks available